IV. Electromagnetic Compatibility Evaluation Conclusions

Electromagnetic Compatibility Evaluation

Conclusions

From the tests performed in the anechoic chamber, it can be concluded that the common building materials tested exhibited a varying range of attenuation of the EUT's re-radiating GPS signal. The composition of the structure in which the EUT is intended to be located is one of the factors that will determine the distance and effective radiated power of the GPS re-radiated signal. Consideration of the building material should be taken when installing a GPS re-radiator kit.

Further, from the tests performed in the loading bay at MET Labs, it can be concluded that, under these conditions, an errant signal can be detected outside of the MET Labs building (test site) at a distance of 27.88 meters from the re-radiating antenna (13.12 meters away from the building). From this observation, and tests performed on common building materials, a person installing a GPS re-radiator into a site should be able to extrapolate a "safe zone" where other GPS receivers should be able to function without interference. It should also be noted that all measurements and observations were made using a GPS re-radiator kit described in the beginning of this report. Care should be taken using any other variation of the GPS re-radiator kit. After installation, measurements should be taken to ensure the "safe zone" of operation. A GPS receiver of the variety common to that particular installation should be used.

V. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Date(s):May 14, 2003					
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1T4080	High Frequency Spectrum Analyzer	Hewlett Packard	8563A	09/22/2002	09/22/2003
1T2665	Horn Antenna	EMCO	3115	03/07/2003	03/07/2004
1T4148	Semi-Anechoic Chamber	Rantec	20	05/30/2002	05/30/2003

End of Report

Exhibit C

US Army DD 1494 filed with NTIA for clearance for re-radiation kits

APPLICATION FOR SPECTRUM REVIEW	UNCLASSIFIED 31 Jul 2002	PAGE 1 OF 9

NTIA GENERAL INFORMATION

1. APPLICATION TITLE (U) GPS Networking L1 Re-Radiating Kit

2. SYSTEM NOMENCLATURE (U) GPS L1 Band Re-Radiating Kit

3. STAGE OF ALLOCATION (U) ☐ a. STAGE 1 CONCEPTUAL ☐ b. STAGE 2 EXPERIMENTAL ☐ c. STAGE 3 DEVELOPMENTAL ☒ d. STAGE 4 OPERATIONAL

4. FREQUENCY REQUIREMENTS
   a. FREQUENCY(IES) (U) 1585 Hz - 1585 Hz
   b. EMISSION DESIGNATORS (U) 24M8G1D

5. PURPOSE OF SYSTEM, OPERATIONAL AND SYSTEM CONCEPTS (MARITIME USE) ☐ a. YES ☒ b. NO
   (U) The system is used to re-radiate GPS signals within a building. This enables the operation of GPS receiving equipment to support testing.

6. INFORMATION TRANSFER REQUIREMENT(U) NA

7. ESTIMATED INITIAL COST OF THE SYSTEM (U) 5300 each unit

8. TARGET DATE FOR

a. APPLICATION APPROVAL	b. SYSTEM ACTIVATION	c. SYSTEM TERMINATION
(U) 10-31-2002	(U) 12-15-2002	(U) NA

9. SYSTEM RELATIONSHIP AND ESSENTIALITY (U) NA

10. REPLACEMENT INFORMATION (U) NA

11. RELATED ANALYSIS AND/OR TEST DATA (U) NA

12. NUMBER OF MOBILE UNITS (U) NA

13. GEOGRAPHICAL AREA FOR
   a. STAGE 2 (U) NA
   b. STAGE 3 (U) NA
   c. STAGE 4 (U) USGP

14. FREQ DIAGRAMS (U) See Page(s) 9	15. SPACE SYSTEMS (U) See Page(s) NA
16. TYPE OF SERVICE(S) FOR STAGE 4 (U) Fixed	17. STATION CLASS(ES) FOR STAGE 4 (U) FX

18. REMARKS (U) General Comment: These systems are only used for the re-transmission of GPS signal within the confines of a building.

DOWNGRADING INSTRUCTIONS	JAF 12/07/02
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TRANSMITTER EQUIPMENT CHARACTERISTICS

1. NOMENCLATURE, MANUFACTURER'S MODEL NO.
(U) NI A20RPDC-N/5/110 (See Remarks)

2. MANUFACTURER'S NAME
(U) GPS NETWORKING,INC.

3. TRANSMITTER INSTALLATION
(U) STATIONARY, CEILING MOUNT, INDOOR

4. TRANSMITTER TYPE
(U) LINEAR, REPEATER

5. TUNING RANGE
(U) 1565 MHz - 1585 MHz

6. METHOD OF TUNING
(U) NA

7. RF CHANNELING CAPABILITY
(U) NA

8. EMISSION DESIGNATORS
(U) 24M0G1D (U) (U)

9. FREQUENCY TOLERANCE
(U) NA

10. FILTER EMPLOYED
(U) [ ] a. YES [X] b. NO

11. SPREAD SPECTRUM
(U) [X] a. YES [ ] b. NO

12. EMISSION BANDWIDTH
[ ] CALCULATED [X] MEASURED

a. -3 dB (U)	15 MHz	(U)	(U)
b. -20 dB (U)	25 MHz	(U)	(U)
c. -40 dB (U)	50 MHz	(U)	(U)
d. -60 dB (U)	65 MHz	(U)	(U)
e. OC-BW (U)	41 MHz	(U)	(U)

13. MAXIMUM BIT RATE
(U) 10.23 Mbps

14. MODULATION TECHNIQUES AND CODING
(U) DSSS; QPSK with 10.23 MHz PRN code

15. MAXIMUM MODULATION FREQUENCY
(U) NA

16. PRE-EMPHASIS
(U) [ ] a. YES [X] b. NO

17. DEVIATION RATIO
(U) NA

18. PULSE CHARACTERISTICS

a. RATE (U)	NA	(U)	(U)
b. WIDTH (U)	NA	(U)	(U)
c. RISE TIME (U)	NA	(U)	(U)
d. FALL TIME (U)	NA	(U)	(U)
e. COMP RATIO (U)	NA	(U)	(U)

19. POWER

a. MEAN (U)	See Remarks	(U)	(U)
b. PEP (U)	NA	(U)	(U)

20. OUTPUT DEVICE
(U) TRANSISTOR DEVICE

21. HARMONIC LEVEL

a. 2nd	(U)	-80 dB
b. 3rd	(U)	-80 dB
c. OTHER	(U)	-80 dB

22. SPURIOUS LEVEL
(U) -80 dB

23. FCC TYPE ACCEPTANCE NO.
(U) NA

24. REMARKS (U)

Item 1 and 2: There are two vendors with very similar characteristics and implementation approach. The information stated on the form are for the GPS Networking, Inc. The second vendor is GPS Source with transmitter part All.

Item 4: The transmitter section, for the GPS Networking system, is implemented as a 20dB amplifier that re-broadcasts, indoors, the GPS signal that is received from outdoors by the receiver section. There is no additional modulation imparted on the GPS signal. The transmitter section for the GPS Source system is implemented with a 30 dB amplifier.

Item 19: The GPS signal reaches the earth at -157 to -160 dBW. The entire GPS Networking system (the receiving antenna, receiver LNA (40 dB), interconnecting cable losses (7 dB), and transmitter amp (20 dB) will impart a maximum of 56 dB of gain. Thus, the transmit power is

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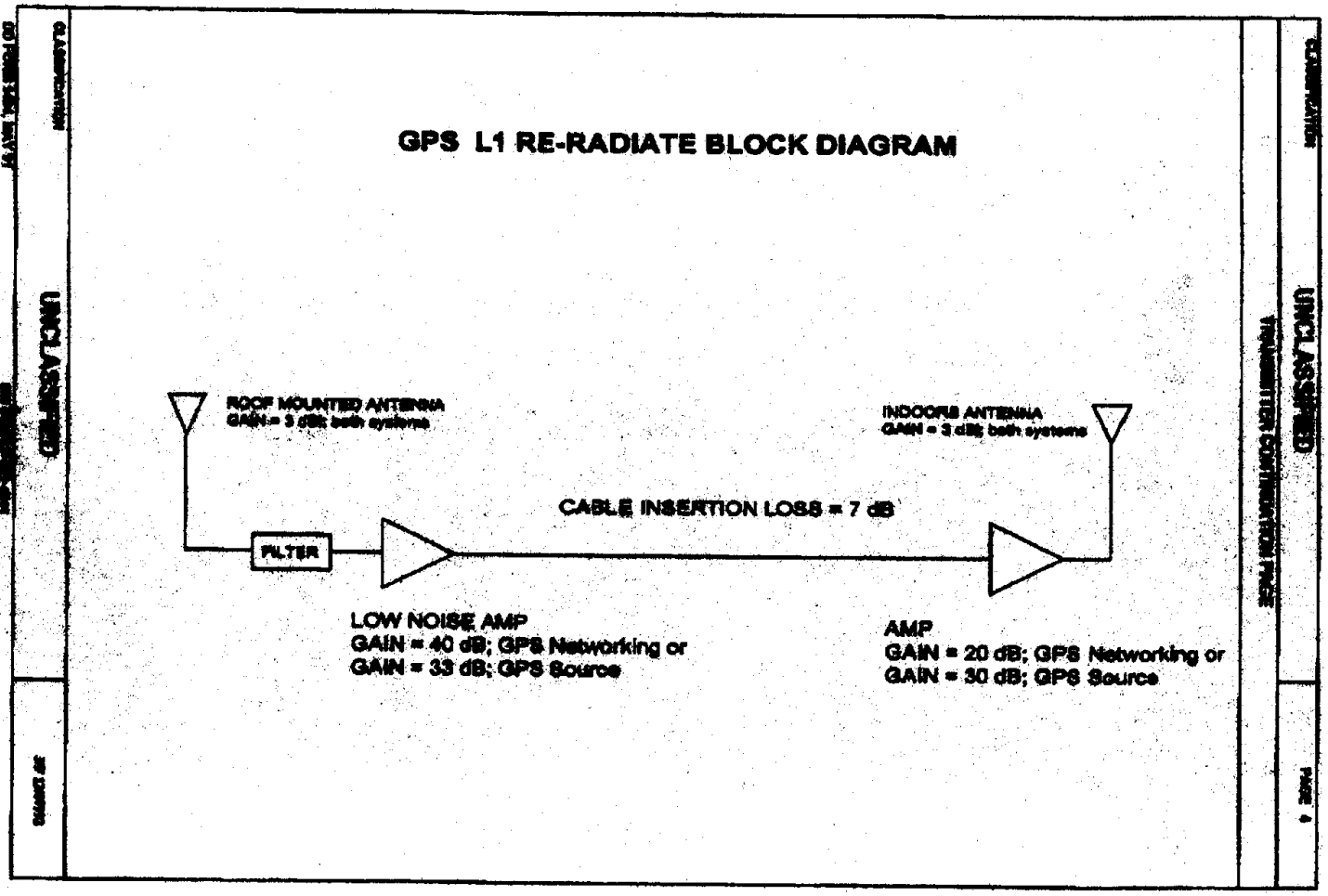
TRANSMITTER REMARK OVERFLOW PAGE

-103.5 dBW Max (70.8 picowatts). See Transmitter Continuation Page for a block diagram of the system.

The ewsira GPS Jammer system (two receiving antenna, receiver LNA (33 dB), Interconnect/Cable Losses (7 dB), and transmitter amp (30 dB) will impart a minimum 50-90 dB of gain. Thus, the transmit power is -80.5 dBW Max (142 pW/watts). See Transmitter Continuation Page for a block diagram of the system.


GPS L1 RE-RADIATE BLOCK DIAGRAM
ROOF MOUNTED ANTENNA
GAIN = 3 dBi; both systems
INDOOR ANTENNA
GAIN = 3 dBi; both systems
CABLE INSERTION LOSS = 7 dB
FILTER
LOW NOISE AMP
GAIN = 40 dB; GPS Networking or
GAIN = 33 dB; GPS Source
AMP
GAIN = 20 dB; GPS Networking or
GAIN = 30 dB; GPS Source
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RECEIVER EQUIPMENT CHARACTERISTICS

1. NOMENCLATURE, MANUFACTURER'S MODEL NO.
(U) GSP-SB2 (See Remarks)

2. MANUFACTURER'S NAME
(U) Allis Communications

3. RECEIVER INSTALLATION
(U) Fixed Mount-Building Roof-Outdoors

4. RECEIVER TYPE
(U) Amplify (See Remarks)

5. TUNING RANGE
(U) 1565.42 MHz - 1585.42 MHz

6. METHOD OF TUNING
(U) NA

7. RF CHANNELING CAPABILITY
(U) NA

8. EMISSION DESIGNATORS
(U) 24M0G1D

9. FREQUENCY TOLERANCE
(U) NA

11. RF SELECTIVITY
[ ] CALCULATED [X] MEASURED

10. IF SELECTIVITY	1st (U)	2nd (U)	3rd (U)
a. -3 dB	NA	NA	NA
b. -20 dB	NA	NA	NA
c. -60 dB	NA	NA	NA

11. RF SELECTIVITY		
a. -3 dB	(U)	40 MHz
b. -20 dB	(U)	90 MHz
c. -60 dB	(U)	250 MHz
d. Preselection Type	(U)	4 Pole Dielectric

12. IF FREQUENCY
a. 1st (U) NA
b. 2nd (U) NA
c. 3rd (U) NA

13. MAXIMUM POST DETECTION FREQUENCY
(U) NA

14. MINIMUM POST DETECTION FREQUENCY
(U) NA

15. OSCILLATOR TUNED

	1st (U)	2nd (U)	3rd (U)
a. ABOVE TUNED FREQUENCY			
b. BELOW TUNED FREQUENCY			
c. EITHER ABOVE OR BELOW THE FREQUENCY			

16. MAXIMUM BIT RATE
(U) NA

17. SENSITIVITY
a. SENSITIVITY (U) -101 dBm
b. CRITERIA (U) 0 dB
c. NOISE FIG (U) 1.6 dB
d. NOISE TEMP (U)

18. DE-EMPHASIS
(U) [ ] a. YES [X] b. NO

19. IMAGE REJECTION
(U) NA

20. SPURIOUS REJECTION
(U) NA

21. REMARKS (U) Items 1 and 2: The this information on the form is for the GPS Networking system. The receiver for the GPS Source system is the GA 1575N manufactured by Ace Technology.
Item 4: The receiver for the GPS Networking system is implemented with a 40 dB LNA, a the highly selective dielectric patch antenna and a dielectric filter serving as preselection. No frequency conversion is performed nor is there any kind of detection performed. The intent is for the receiving antenna and LNA to collect the GPS signal outdoors in view of the GPS constellation for re-broadcasting of the signal indoors by the transmitter section. The receiver for the GPS Source system is implemented with a 33 dB LNA, a the highly selective dielectric patch antenna and a dielectric filter serving as preselection.

Item 17: Sensitivity is calculated using 0.0 dBm Minimum Detectable Signal, a Noise Figure of 1.6 dB, and RF 3 dB bandwidth of 40 MHz.

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JVF 12/07992

ANTENNA EQUIPMENT CHARACTERISTICS

1. (U) [ ] a. TRANSMITTING [X] b. RECEIVING [ ] c. TRANSMITTING AND RECEIVING

2. NOMENCLATURE, MANUFACTURER'S MODEL NO.
(U) GPS SB2 (See Remarks)

3. MANUFACTURER'S NAME
(U) Allis Communications

5. TYPE (U) Dielectric Patch

4. FREQUENCY RANGE
(U) 1565 MHz - 1585 MHz

7. SCAN CHARACTERISTICS
a. TYPE (U) NA

6. POLARIZATION
(U) Right-Hand Circular

b. VERTICAL SCAN (U) NA
(1) Max Elev (U) NA
(2) Min Elev (U) NA
(3) Scan Rate (U) NA

8. GAIN
a. MAIN BEAM
(U) 3 dBi

c. HORIZONTAL SCAN (U) NA
(1) Sector Scanned (U) NA
(2) Scan Rate (U) NA

b. 1st MAJOR SIDE LOBE
(U) NA

9. BEAMWIDTH
a. HORIZONTAL
(U) 360 deg
b. VERTICAL
(U) 180 deg

d. SECTOR BLANKING (U) [ ] (1) YES [X] (2) NO

10. REMARKS (U)

Item 1: This antenna is used by both system for their indoors antenna.

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J/F 12/07992

ANTENNA EQUIPMENT CHARACTERISTICS

1. (U) [X] a. TRANSMITTING [ ] b. RECEIVING [ ] c. TRANSMITTING AND RECEIVING

2. NOMENCLATURE, MANUFACTURER'S MODEL NO.
(U) GPS-P2 (See Remarks)

3. MANUFACTURER'S NAME
(U) Allis Communications

4. FREQUENCY RANGE
(U) 1565 MHz - 1585 MHz

5. TYPE (U) Dielectric Patch

6. POLARIZATION
(U) Right-Hand Circular

7. SCAN CHARACTERISTICS
a. TYPE (U) NA

8. GAIN
a. MAIN BEAM
(U) 3 dBi

b. VERTICAL SCAN (U) NA
(1) Rate Step (U) NA
(2) Max Step (U) NA
(3) Step Rate (U) NA

c. HORIZONTAL SCAN (U) NA
(1) Rate Scanned (U) NA
(2) Step Rate (U) NA

b. 1st MAJOR SIDE LOBE
(U)

9. BEAMWIDTH
a. HORIZONTAL
(U) 360 deg
b. VERTICAL
(U) 180 deg

d. SECTOR BLANKING (U) [ ] (1) YES [X] (2) NO

10. REMARKS (U)

Item 1: This antenna is used for outdoors reception by the GPS Networking system.

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ANTENNA EQUIPMENT CHARACTERISTICS

1. (U) [ ] a. TRANSMITTING [X] b. RECEIVING [ ] c. TRANSMITTING AND RECEIVING

2. NOMENCLATURE, MANUFACTURER'S MODEL NO.
(U) GPS Antenna

3. MANUFACTURER'S NAME
(U) Ace Technology

4. FREQUENCY RANGE
(U) 1559 MHz - 1606 MHz

5. TYPE (U)

6. POLARIZATION
(U)

7. SCAN CHARACTERISTICS
a. TYPE (U) NA

6. GAIN
a. MAIN BEAM
(U) 3 dBi

b. VERTICAL SCAN (U) NA
(1) Max Elev (U) NA
(2) Min Elev (U) NA
(3) Scan Rate (U) NA

b. 1st MAJOR SIDE LOBE
(U) NA

c. HORIZONTAL SCAN (U) NA
(1) Sector Scanned (U) NA
(2) Scan Rate (U) NA

9. BEAMWIDTH
a. HORIZONTAL
(U) 360 deg

b. VERTICAL
(U) 180 deg

d. SECTOR BLANKING (U) [ ] (1) YES [X] (2) NO

10. REMARKS (U)

Item 1: This antenna is used by the GPS Source system for outdoors reception of the signal.

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DD FORM 1494, MAY 91 SN 0102-LF-001-4901

LINE DIAGRAM